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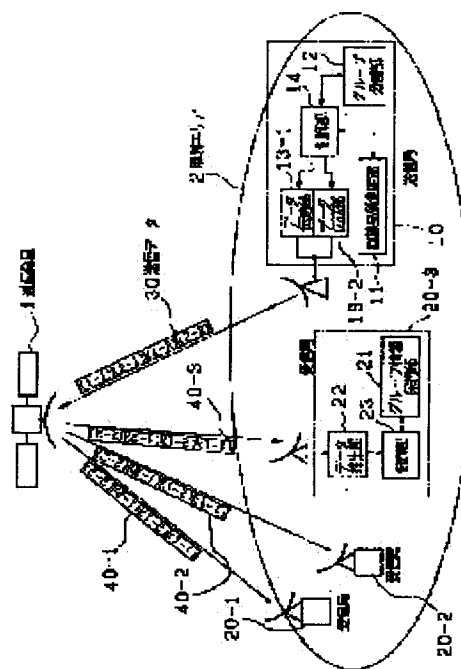
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H04B 7/26(21)Application number : 03-287825 (71)Applicant : NIPPON TELEGR & TELEPH CORP
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(54) MULTIPLE ADDRESS COMMUNICATION DATA TRANSMISSION METHOD FOR RADIO COMMUNICATION

(57)Abstract:

PURPOSE: To provide the multiple address communication data transmission method in which data transmission is finished in a short time for a reception station with excellent line quality even when a reception station with deteriorated line quality is in existence.

CONSTITUTION: In the multiple address communication data transmission method in radio communication in which data are sent from a transmission station 10 simultaneously to plural reception stations 20-1-20-3, the plural reception stations 20-1-20-3 are divided into two groups or over based on the result of the measurement of the line quality from the transmission station 10 to the plural reception stations 20-1-20-3 or its reception performance and location or the like or both of them prior to the transmission of the multiple address communication data, and the transmission station 10 sends the multiple address communication data to each group of the plural reception stations 20-1-20-3 and the line between the transmission station and the reception stations belonging to each group is disconnected sequentially for each group whose transmission is finished.



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CLAIMS

[Claim(s)]

[Claim 1] In the multiple address data transmission approach in the radio which transmits data to coincidence from the radio station of 1 to two or more of other radio stations As opposed to the radio station of everything [in advance of transmission of multiple address data, measure the quality of the circuit from the radio station of 1 to two or more of other radio stations, respectively, divide two or more of other radio stations into two or more groups based on this measurement result, and / radio station / of 1] but plurality The multiple address data transmission approach in the radio characterized by making as [cut / the circuit of the other radio stations which belong to this group one by one for every group and the radio station of 1 which transmitted multiple address data for said every group, and transmission completed].

[Claim 2] In the multiple address data transmission approach in the radio which transmits data to coincidence from the radio station of 1 to two or more of other radio stations As opposed to the radio station of everything [based on the receiving engine performance, an address, etc., divide two or more of other radio stations into two or more groups, and / radio station / of 1] but plurality The multiple address data transmission approach in the radio characterized by making as [cut / the circuit of the other radio stations which belong to this group one by one for every group and the radio station of 1 which transmitted multiple address data for said every group, and transmission completed].

[Claim 3] In the multiple address data transmission approach in the radio which transmits data to coincidence from the radio station of 1 to two or more of other radio stations In advance of transmission of multiple address data, the quality of the circuit from the radio station of 1 to two or more of other radio stations is measured, respectively. As opposed to the radio station of everything [based on the receiving engine performance, an address, etc., divide two or more of other radio stations into two or more groups at this measurement result list, and / radio station / of 1] but plurality The multiple address data transmission approach in the radio characterized by making as [cut / the circuit of the other radio stations which belong to this group one by one for every group and the radio station of 1 which transmitted multiple address data for said every group, and transmission completed].

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the multiple address data transmission approach in radio, such as satellite communication.

[0002]

[Description of the Prior Art] In a satellite communication system, broadcast is in one of the communication service which employed the size of the exposure area of a communication satellite efficiently.

[0003] Drawing 2 shows an example of this conventional kind of the multiple address data transmission approach, and, for one, as for the exposure area of a communication satellite 1, and 3, a communication satellite and 2 are [a sending station and 4-1 to 4-3] receiving stations among drawing. In said configuration, when transmit data 5 is transmitted from a sending station 3 only once to a communication satellite 1, received data 6-1, 6-2, and 6-3 (the contents are the same as that of transmit data 5) will be transmitted from a communication satellite 1 to two or more receiving stations 4-1 to 4-3, respectively, and simultaneous transmission of the same data, i.e., the multiple address, will be made. In addition, transmit data 5 and received data 6-1 to 6-3 are the figure (1) which consisted of three data frames a the plurality which has a predetermined frame structure, and here, and was given to each data frame, (2), and (3). A frame number is shown.

[0004] By the way, by said system, when the quality of the circuit by the communication satellite 1 is bad, it is possible to produce a data error. For this reason, it is necessary to apply an ARQ (Auto Repeat Request) method for obtaining the higher transmission quality.

[0005] Drawing 3 shows the example of transmission of the multiple address data at the time of applying an SR(Selective Repeat)-ARQ method to the communication system of drawing 2 , and the transmit data with which seven were transmitted to the communication satellite 1 from the sending station 3, and 8-1 to 8-3 are the received data transmitted to the receiving station 4-1 to 4-3 from the communication satellite 1 among drawing. In addition, the frame containing a slash shows the data frame received accidentally among received-data 8-1 - 8-3.

[0006] A SR-ARQ method is an ARQ method which carries out the resending demand only of the frame with which the error was detected among the data frames which the receiving station received, and has the best transmission efficiency in the fundamental ARQ method in an one-to-one communication link. That is, it is Pf about a frame error rate. It carries out and infinity, then its transmission efficiency are set to $(1-Pf)$ in the buffer capacity in a receiving station.

[0007] However, in applying an ARQ method to broadcast, an effectual frame error rate changes with numbers of receiving stations. now and a receiving station -- n games -- existing -- frame error rate Pf with all equal receiving stations it is -- supposing -- the effectual frame error rate (probability for an error to arise among n games in one of receiving stations) Ps seen from the sending station -- $Ps = 1 - (1 - Pf)^n$ It becomes. It is because the frame must be resent in broadcast if the frame transmitted from the sending station is received accidentally in at least one office in all receiving stations. That is, when applying an ARQ method to broadcast, they are the increment in a several n receiving station, and the frame error rate Pf of a receiving station.

Degradation becomes the factor which reduces transmission efficiency. It is the frame error rate Pf further again. If at least one extremely bad receiving station exists, all other receiving stations with sufficient circuit quality will cause decline in transmission efficiency under the effect of the receiving station.

[0008] In the example of drawing 3 , since it sets to received data 8-3, and the data of frame number (1) - (5) are continuing being received accidentally, namely, all the data of frame number (1) - (5) are continuing being received accidentally in a receiving station 4-3, the data frame of frame number (1) - (5) is continuing being repeatedly sent out into transmit data 7.

Consequently, in received data 8-1 and 8-2, the data of frame number (1) - (5) are received correctly, namely, although all the data of frame number (1) - (5) are already correctly received by a receiving station 4-1 and 4-2, the same data will continue being received until said receiving station 4-3 can receive correctly.

[0009]

[Problem(s) to be Solved by the Invention] Thus, when the ARQ method was applied to broadcast as it was, the receiving station where circuit quality is bad reduced the transmission efficiency of a receiving station with sufficient circuit quality and at least especially one receiving station where circuit quality is extremely bad existed, the transmission efficiency of all other receiving stations was reduced remarkably, and there was a trouble of carrying out long duration restraint to a receiving station with sufficient circuit quality.

[0010] This invention solves the conventional trouble mentioned above, even if the receiving station where circuit quality is bad exists, data transmission is made to complete to a receiving station with sufficient circuit quality for a short time, and it aims at offering long duration and the multiple address data transmission approach without restricting unnecessarily.

[0011]

[Means for Solving the Problem] In the multiple address data transmission approach in the radio which transmits data to coincidence from the radio station of 1 to two or more of other radio stations as claim 1 in order to solve said trouble in this invention As opposed to the radio station of everything [in advance of transmission of multiple address data, measure the quality of the circuit from the radio station of 1 to two or more of other radio stations, respectively, divide two or more of other radio stations into two or more groups based on this measurement result, and / radio station / of 1] but plurality As the multiple address data transmission approach in the radio made as [cut / the circuit of the other radio stations which belong to this group one by one for every group and the radio station of 1 which transmitted multiple address data for said every group, and transmission completed], and claim 2 In the multiple address data transmission approach in the radio which transmits data to coincidence from the radio station of 1 to two or more of other radio stations As opposed to the radio station of everything [based on the receiving engine performance, an address, etc., divide two or more of other radio stations into two or more groups, and / radio station / of 1] but plurality As the multiple address data transmission approach in the radio made as [cut / the circuit of the other radio stations which belong to this group one by one for every group and the radio station of 1 which transmitted multiple address data for said every group, and transmission completed], and claim 3 In the multiple address data transmission approach in the radio which transmits data to coincidence from the radio station of 1 to two or more of other radio stations In advance of transmission of multiple address data, the quality of the circuit from the radio station of 1 to two or more of other radio stations is measured, respectively. As opposed to the radio station of everything [based on the receiving engine performance, an address, etc., divide two or more of other radio stations into two or more groups at this measurement result list, and / radio station / of 1] but plurality Multiple address data are transmitted for said every group, and the multiple address data transmission approach in the radio made as [cut / the circuit of the other radio stations which belong to this group one by one for every group and the radio station of 1 which transmission completed] is proposed.

[0012]

[Function] According to claim 1 of this invention, in advance of transmission of multiple address data, the quality of the circuit from the radio station of 1 to two or more of other radio stations

is measured, respectively. As opposed to the radio station of everything [based on this measurement result, two or more of other radio stations are divided into two or more groups, and / radio station / of 1] but plurality Transmission of multiple address data is performed for said every group, and the circuit of the other radio stations which belong to this group one by one for every group and the radio station of 1 which transmission completed is cut. Moreover, according to claim 2, two or more of other radio stations are divided into two or more groups based on the receiving engine performance, an address, etc., transmission of multiple address data is performed from the radio station of 1 for said every group to two or more of other radio stations, and the circuit of the other radio stations which belong to this group one by one for every group and the radio station of 1 which transmission completed is cut. Moreover, according to claim 3, in advance of transmission of multiple address data, the quality of the circuit from the radio station of 1 to two or more of other radio stations is measured, respectively. As opposed to the radio station of everything [based on the receiving engine performance, an address, etc., two or more of other radio stations are divided into two or more groups at this measurement result list, and / radio station / of 1] but plurality Transmission of multiple address data is performed for said every group, and the circuit of the other radio stations which belong to this group one by one for every group and the radio station of 1 which transmission completed is cut.

[0013]

[Example] Drawing 1 shows one example of the multiple address data transmission approach in the radio of this invention, and, for the exposure area of a communication satellite 1, and 10, as for a receiving station and 30, a sending station, 20-1, 20-2, and 20-3 are [one / a communication satellite and 2 / transmit data, 40-1, 40-2, and 40-3] received data among drawing.

[0014] The sending station 10 is equipped with the circuit quality test section 11, the group division section 12, the data transmission section 13-1 and 13-2, and a control section 14. In advance of transmission of multiple address data, the circuit quality test section 11 is measured by carrying out so that the quality of the circuit to each receiving station 20-1 to 20-3 may be mentioned later, respectively. The group division section 12 divides each receiving station 20-1 to 20-3 into two or more groups, the group G1 with circuit quality sufficient here, and the group G2 with bad circuit quality based on the measurement result searched for by said circuit quality test section 11. The data transmission section 13-1 and 13-2 perform independently data transmission by the SR-ARQ method to the receiving station belonging to groups G1 and G2, respectively. A control section 14 performs connection, cutting control, etc. of the notice of various kinds of information to a receiving station, and a circuit while it controls said each part and performs measurement of circuit quality, group division, and multiple address data transmission.

[0015] The receiving station 20-1 to 20-3 is equipped with the group information attaching part 21, the data extraction section 22, and a control section 23, respectively (however, these show a receiving station 20-3 on account of a drawing.). The group information attaching part 21 holds the group number G1 or G2 here [group information and here] where it is notified from a sending station 10. The data extraction section 22 extracts only the data corresponding to the group who corresponds from the inside of the data received. A control section 23 performs sending out of various kinds of reply signals to a sending station etc. while it controls said each part and performs the group information maintenance and data extraction.

[0016] Drawing 4 shows the transmit timing of the reply signal from a receiving station, and an example of the frame structure to the frame structure list of the transmit data in said system. inside of drawing, and 30a — one frame of transmit data 30 — being shown — unique WORD a1 and control signal a2 And data a3 from — it is constituted. Moreover, 50-1, 50-2, and 50-3 are the reply signals of a receiving station 20-1, 20-2, and 20-3 among drawing, respectively, and these signals are the control signals a2 of transmit data 30. It is transmitted in time sharing so that it may not collide mutually based on the timing information set up and transmitted to inside. one frame of this reply signal 50-1 to 50-3 — unique WORD b1 and control signal b2 And data b3 from — it is constituted and this reply signal 50-1 to 50-3 is used as measurement of the

circuit quality for every receiving station 20-1 to 20-3, or a reply signal for ARQ.

[0017] Next, actuation of said system is explained.

[0018] First, the control section 14 of a sending station 10 is the control signal b2 in transmit data 30. The purport which uses and measures circuit quality is notified to all receiving stations. Each receiving station 20-1 to 20-3 is the data b3 of a reply signal by the control section 23, when said notice is received. While setting PN pattern for measurement of circuit quality as inside, it is a control signal b2. The information which shows the purport which is transmitting this PN pattern is set as inside, and this is transmitted to it.

[0019] A sending station 10 will measure the circuit quality to each receiving station 20-1 to 20-3 by comparing PN pattern in this reply signal with PN pattern generated inside in the circuit quality test section 11, if said reply signal is received. In addition, discernment of each receiving station 20-1 to 20-3 is the control signal b2 of a reply signal. It is realizable by setting each office number as inside.

[0020] Next, by the group division section 12, based on the measurement result of the circuit quality mentioned above, division 20-1, for example, a receiving station, and 20-2 are divided into a group G1, and a sending station 10 divides a receiving station 20-3 into a group G2 for a receiving station 20-1 to 20-3 at groups G1 and G2. Furthermore, the control section 14 of a sending station 10 uses transmit data 30 for the result of said group division, namely, is a control signal a2. The group number is set as data a3, and the office number of a receiving station is notified to each receiving station 20-1 to 20-3 again. In addition, since this notice needs to guarantee sufficient reliability, continuous transmission of it is continued and carried out to two or more frames. Each receiving station 20-1 to 20-3 will write the corresponding group number in the group information attaching part 21, respectively, if said notice is received.

[0021] Then, the control section 14 of a sending station 10 is the control signal a2 of transmit data 30. It uses, transmission initiation of multiple address data is notified to all receiving stations, and each receiving station 20-1 to 20-3 which received this notice will be in the state waiting for data transmission.

[0022] Next, to the data which it is going to transmit, the control section 14 of a sending station 10 adds the group number to the control signal for every data frame, makes with the data corresponding to each groups G1 and G2, and is distributed to the data transmission section 13-1 and 13-2. The data transmission section 13-1 and 13-2 transmit transmit data 30, nothing, and this to each receiving station 20-1 to 20-3 for every frame, respectively, combining the data corresponding to groups G1 and G2 by turns.

[0023] Although said transmit data 30 will be received in each receiving station 20-1 to 20-3 as received data 40-1 to 40-3 (the contents are the same as that of transmit data 30), respectively. The data extraction section 22 of each receiving station 20-1 to 20-3 only the data corresponding to the group who corresponds from received data 40-1 to 40-3, respectively. That is, only the data frame of group G1 correspondence is extracted in a receiving station 20-1 and 20-2, and only the data frame of group G2 correspondence is extracted in a receiving station 20-3, and it receives. Moreover, if there is a correctly unreceivable data frame in this case, the control section 23 of each receiving station 20-1 to 20-3 will be the control signal b2 of a reply signal. While setting as inside the information which shows the purport which are the office number or the group number, and a resending demand, that frame number is set up into data b3, and this is transmitted.

[0024] Then, when transmission of the data in one of groups is completed, a sending station 10 is the control signal a2 of transmit data 30. Cutting of the circuit of broadcast is notified to the receiving station which uses and belongs to an applicable group.

[0025] In addition, the figure (1-1) given to each frame of transmit data 30 and received data 40-1 to 40-3, (2-1), and (1-2) (2-2), A front figure shows the group number inside, and a back figure shows a frame number, respectively.

[0026] Drawing 5 shows the example of transmission of the multiple address data in said system, and, as for 31, transmit data, 41-1, 41-2, and 41-3 are received data among drawing. In addition, the frame containing a slash shows the data frame received accidentally among received-data 41-1 - 41-3. Although it sets to received data 41-3, and the data of frame number (1) - (3) are

continuing being received accidentally, namely, all the data of frame number (1) - (3) are continuing being received accidentally here in the receiving station 20-3 belonging to a group G2. In received data 41-1 and 41-2, the data of frame number (1) - (3) are received correctly. That is, since all the data of - (3) are received correctly, the data frame of frame number (1) frame number [corresponding to a group G1] (1) - (3) is not repeatedly sent out to the receiving station 20-1 belonging to a group G1, and 20-2 into transmit data 31. Consequently, -2 adheres to a repetition of a data frame, a receiving station 20-1, and the transmit data to a receiving station 20-3, i.e., 20 frame-number (1) -, (3), there is nothing, and the thing of a new frame number (4), (5), and for which a data frame is received becomes possible.

[0027] In addition, although the group division of each receiving station was carried out based on the measurement result of circuit quality in said example, it is also possible to be also able to carry out a group division beforehand from the class (a helical antenna, electronic tailing antenna, etc.) of antenna of a receiving station, an address, receiving engine performance -- the center or edge of exposure area, whether it is at sea, or it is ashore -- etc., and to carry out a group division based on both these and said measurement result.

[0028] Drawing 6 shows other examples of transmission of the multiple address data in this invention, and shows the case where it makes as [perform / multiple address data transmission], to a group G1 here with the FEC/ARQ method which combined SR-ARQ and an error correction to the group G2 with the SR-ARQ method again. That is, among drawing, transmit data, 42-1, 42-2, and 42-3 are received data, and 32 show the data frame which recovered the data frame by which the frame containing a slash with narrow spacing was received accidentally by the error correction although the frame into which the slash with large spacing went again was received accidentally among received-data 42-1 - 42-3.

[0029] Although the receiving station 20-1 where this example belongs to a group G1, and 20-2 have good circuit quality and data transmission with high transmission efficiency is possible by the SR-ARQ method. Since the receiving station 20-3 belonging to a group G2 has bad circuit quality and transmission efficiency sufficient by the SR-ARQ method is not acquired. It is not necessary not only to affect the receiving station belonging to a group G1, but it makes as [perform / a FEC/ARQ method / data transmission], and the efficient data transmission of the receiving station belonging to a group G2 becomes possible to the receiving station belonging to a group G2.

[0030] Drawing 7 shows the example of transmission of further others of the multiple address data in this invention, and while applying an SR-ARQ method to groups G1 and G2, transmission of a data frame is performed from a group G1, and here shows the case where it makes as [transmit / the data frame to a group G2], after transmission to this group G1 is completed. Namely, as for 33, the data frame by which transmit data, 43-1, 43-2, and 43-3 are received data, and were received accidentally [frame / into which the slash went among received-data 43-1 - 43-3] is shown among drawing.

[0031] According to this example, transmission of data [as opposed to a group G2 in under transmission of the data to a group G1] is not performed. Moreover, since the receiving station belonging to a group G1 has good circuit quality and data transmission with high transmission efficiency is possible. It can be made to complete for a short time extremely, without being influenced of the receiving station 20-3 which belongs the receiving station 20-1 belonging to this group G1, and the data transmission to 20-2 to the group G2 with bad circuit quality.

[0032] In addition, in this invention, you may make as [transmit / only the count beforehand decided according to the quality of the circuit for every group / data], without using an ARQ method. Moreover, although old explanation explained the sending station and the receiving station as another thing, it is arbitrary whether which radio station turns into a sending station or it becomes a receiving station.

[0033]

[Effect of the Invention] As explained above, according to claim 1 of this invention, by measuring the quality of the circuit from the radio station of 1 to two or more of other radio stations, respectively. By being able to divide two or more of other radio stations of a receiving side into two or more [per circuit quality] groups, and transmitting multiple address data for every group

who this divided from the radio station of 1 of a transmitting side to two or more of other radio stations of a receiving side It is not influenced of the radio station where the radio station belonging to a group with sufficient circuit quality belongs to a group with bad circuit quality. By cutting the circuit of the radio station of a receiving side and the radio station of a transmitting side which became possible [performing efficient data transmission], and transmission completed and which belong to this group one by one for every group Other communication links can be performed without being able to make the radio station belonging to a group with sufficient circuit quality open wide from the circuit of multiple address data beyond the radio station belonging to a group with bad circuit quality, and restricting it unnecessarily.

[0034] Moreover, according to claim 2 of this invention, without measuring the quality of the circuit from the radio station of 1 to two or more of other radio stations in advance of transmission of multiple address data, respectively, based on the receiving engine performance, an address, etc., two or more of other radio stations of a receiving side can be divided into two or more [per circuit quality] groups, the part and a process are simplified, and the burden placed on each radio station becomes light.

[0035] Moreover, according to claim 3 of this invention, as a result of measuring the quality of the circuit from the radio station of 1 to two or more of other radio stations, respectively, based on the receiving engine performance, an address, etc., two or more of other radio stations of a receiving side can be divided into two or more [per circuit quality] groups at a list, and a more exact group division can be performed.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The system configuration Fig. showing one example of the multiple address data transmission approach in the radio of this invention

[Drawing 2] The system configuration Fig. showing an example of the multiple address data transmission approach in the conventional radio

[Drawing 3] The explanatory view showing the example of transmission of the multiple address data at the time of applying a SR-ARQ method to the system of drawing 2

[Drawing 4] The explanatory view showing the transmit timing of the reply signal from a receiving station, and an example of the frame structure in the frame structure list of the transmit data in the system of drawing 1

[Drawing 5] The explanatory view showing the example of transmission of the multiple address data in the system of drawing 1

[Drawing 6] The explanatory view showing other examples of transmission of the multiple address data in this invention

[Drawing 7] The explanatory view showing the example of transmission of further others of the multiple address data in this invention

[Description of Notations]

1 [— Circuit quality test section,] — A communication satellite, 2 — Exposure area, 10 — A sending station, 11 12 — The group division section, 13-1, 13-2 — 14 The data transmission section, 23 — Control section, 20-1 to 20-3 — A receiving station, 21 — The group information attaching part, 22 — Data extraction section, 30, 31, 32, 33 [— / — data. / Unique WORD, a2 b2 — A control signal, a3, and b3] — Transmit data, 40-1 to 40-3, 41-1 to 41-3, 42-1 to 42-3, 43-1 to 43-3 — Received data, 50-1 to 50-3 — A reply signal, a1, and b1

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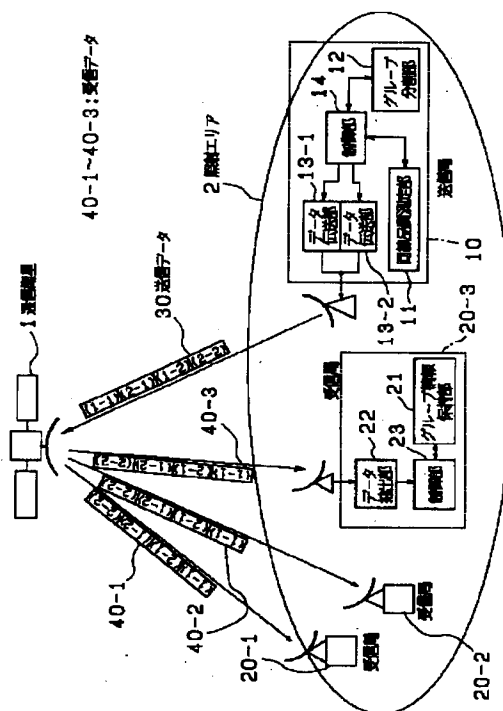
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(54)【発明の名称】 無線通信における同報データ伝送方法

(57)【要約】

【目的】 回線品質の悪い受信局が存在しても回線品質の良い受信局に対しては短時間でデータ伝送を完了させ得る同報データ伝送方法を提供する。

【構成】 送信局10より複数の受信局20-1~20-3に対して同時にデータを伝送する無線通信における同報データ伝送方法において、同報データの伝送に先立って、送信局10から複数の受信局20-1~20-3までの回線の品質をそれぞれ測定した結果あるいはその受信性能、所在地等もしくはこれらの両者に基いて複数の受信局20-1~20-3を2以上のグループに分割し、送信局10より複数の受信局20-1~20-3に対して、前記グループ毎に同報データの伝送を行い、伝送が完了したグループ毎に、順次、該グループに属する受信局と送信局との回線を切断するようになった。



【特許請求の範囲】

【請求項 1】 一の無線局より複数の他の無線局に対して同時にデータを伝送する無線通信における同報データ伝送方法において、同報データの伝送に先立って、一の無線局から複数の他の無線局までの回線の品質をそれぞれ測定し、該測定結果に基づいて複数の他の無線局を 2 以上のグループに分割し、一の無線局より複数の他の無線局に対して、前記グループ毎に同報データの伝送を行い、伝送が完了したグループ毎に、順次、該グループに属する他の無線局と一の無線局との回線を切断するようになったことを特徴とする無線通信における同報データ伝送方法。

【請求項 2】 一の無線局より複数の他の無線局に対して同時にデータを伝送する無線通信における同報データ伝送方法において、複数の他の無線局をその受信性能、所在地等に基づいて 2 以上のグループに分割し、一の無線局より複数の他の無線局に対して、前記グループ毎に同報データの伝送を行い、伝送が完了したグループ毎に、順次、該グループに属する他の無線局と一の無線局との回線を切断するようになったことを特徴とする無線通信における同報データ伝送方法。

【請求項 3】 一の無線局より複数の他の無線局に対して同時にデータを伝送する無線通信における同報データ伝送方法において、同報データの伝送に先立って、一の無線局から複数の他の無線局までの回線の品質をそれぞれ測定し、該測定結果並びにその受信性能、所在地等に基づいて複数の他の無線局を 2 以上のグループに分割し、一の無線局より複数の他の無線局に対して、前記グループ毎に同報データの伝送を行い、伝送が完了したグループ毎に、順次、該グループに属する他の無線局と一の無線局との回線を切断するようになったことを特徴とする無線通信における同報データ伝送方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、衛星通信等の無線通信における同報データ伝送方法に関するものである。

【0002】

【従来の技術】衛星通信システムにおいて、通信衛星の照射エリアの広さを生かした通信サービスの 1 つに同報通信がある。

【0003】図 2 は従来のこの種の同報データ伝送方法の一例を示すもので、図中、1 は通信衛星、2 は通信衛星 1 の照射エリア、3 は送信局、4-1 ~ 4-3 は受信局である。前記構成において、送信局 3 から通信衛星 1

に対して送信データ 5 をただ 1 度送信すると、通信衛星 1 から複数の受信局 4-1 ~ 4-3 に対してそれぞれ受信データ 6-1, 6-2, 6-3 (内容は送信データ 5 と同一) が送信されることになり、同一データの一齐伝送、即ち同報がなされることになる。なお、送信データ 5 及び受信データ 6-1 ~ 6-3 は所定のフレーム構成を有する複数、ここでは 3 つのデータフレーム a からなり、各データフレームに付した数字 (1), (2), (3) はフレーム番号を示す。

10 【0004】ところで、前記システムでは通信衛星 1 による回線の品質が悪い場合、データ誤りを生じることが考えられる。このため、より高い伝送品質を得るには ARQ (Auto Repeat Request) 方式を適用する必要がある。

【0005】図 3 は図 2 の通信システムに SR (Selective Repeat) - ARQ 方式を適用した場合の同報データの伝送例を示すもので、図中、7 は送信局 3 から通信衛星 1 へ伝送された送信データ、8-1 ~ 8-3 は通信衛星 1 から受信局 4-1 ~ 4-3 へ伝送された受信データである。なお、受信データ 8-1 ~ 8-3 中、斜線の入ったフレームは誤って受信されたデータフレームを示す。

20 【0006】SR-ARQ 方式は受信局が受信したデータフレームのうち、誤りの検出されたフレームだけを再送要求する ARQ 方式であり、一対一通信における基本的な ARQ 方式の中では最も良い伝送効率を有する。即ち、フレーム誤り率を P_f とし、受信局におけるバッファ容量を無限大とすれば、その伝送効率は $(1 - P_f)$ になる。

30 【0007】ところが、同報通信に ARQ 方式を適用する場合には、受信局数により実効的なフレーム誤り率が異なってくる。いま、受信局が n 局存在し、全受信局が等しいフレーム誤り率 P_f であるとする、送信局からみた実効的なフレーム誤り率 (n 局のうち、いずれかの受信局で誤りが生ずる確率) P_s は

$$P_s = 1 - (1 - P_f)^n$$

となる。なぜなら、同報通信では送信局から送信したフレームが全受信局のうちの少なくとも 1 つの局に誤って受信されれば、そのフレームを再送しなければならないからである。即ち、同報通信に ARQ 方式を適用する場合には受信局数 n の増加と、受信局のフレーム誤り率 P_f の劣化とが伝送効率を低下させる要因となる。さらにまた、フレーム誤り率 P_f が極端に悪い受信局が 1 つでも存在すれば、その受信局の影響により回線品質の良い他の全ての受信局が伝送効率の低下を招くことになる。

40 【0008】図 3 の例では受信データ 8-3 においてフレーム番号 (1) ~ (5) のデータが誤って受信され続けている、即ち受信局 4-3 にフレーム番号 (1) ~ (5) の全てのデータが誤って受信され続けているため、送信データ 7 中にフレーム番号 (1) ~ (5) のデ

ータフレームが繰返し送出され続けている。この結果、受信データ8-1及び8-2においてフレーム番号

(1)～(5)のデータが正しく受信されている、即ち受信局4-1及び4-2にはフレーム番号(1)～

(5)の全てのデータが既に正しく受信されているにも拘らず、前記受信局4-3が正しく受信できるまで同じデータを受信し続けることになる。

【0009】

【発明が解決しようとする課題】このように同報通信にARQ方式をそのまま適用すると、回線品質の悪い受信局が回線品質の良い受信局の伝送効率を低下させ、特に回線品質の極端に悪い受信局が一局でも存在すれば、他の全ての受信局の伝送効率を著しく低下させ、回線品質の良い受信局までも長時間束縛してしまうという問題点があった。

【0010】本発明は前述した従来の問題点を解決し、回線品質の悪い受信局が存在しても回線品質の良い受信局に対しては短時間でデータ伝送を完了させ、長時間、無意味に束縛することのない同報データ伝送方法を提供することを目的とする。

【0011】

【課題を解決するための手段】本発明では前記問題点を解決するため、請求項1として、一の無線局より複数の他の無線局に対して同時にデータを伝送する無線通信における同報データ伝送方法において、同報データの伝送に先立って、一の無線局から複数の他の無線局までの回線の品質をそれぞれ測定し、該測定結果に基いて複数の他の無線局を2以上のグループに分割し、一の無線局より複数の他の無線局に対して、前記グループ毎に同報データの伝送を行い、伝送が完了したグループ毎に、順次、該グループに属する他の無線局と一の無線局との回線を切断するようになった無線通信における同報データ伝送方法、また、請求項2として、一の無線局より複数の他の無線局に対して同時にデータを伝送する無線通信における同報データ伝送方法において、複数の他の無線局をその受信性能、所在地等に基づいて2以上のグループに分割し、一の無線局より複数の他の無線局に対して、前記グループ毎に同報データの伝送を行い、伝送が完了したグループ毎に、順次、該グループに属する他の無線局と一の無線局との回線を切断するようになった無線通信における同報データ伝送方法、また、請求項3として、一の無線局より複数の他の無線局に対して同時にデータを伝送する無線通信における同報データ伝送方法において、同報データの伝送に先立って、一の無線局から複数の他の無線局までの回線の品質をそれぞれ測定し、該測定結果並びにその受信性能、所在地等に基づいて複数の他の無線局を2以上のグループに分割し、一の無線局より複数の他の無線局に対して、前記グループ毎に同報データの伝送を行い、伝送が完了したグループ毎に、順次、該グループに属する他の無線局と一の無線局との回

線を切断するようになった無線通信における同報データ伝送方法を提案する。

【0012】

【作用】本発明の請求項1によれば、同報データの伝送に先立って、一の無線局から複数の他の無線局までの回線の品質がそれぞれ測定され、該測定結果に基いて複数の他の無線局が2以上のグループに分割され、一の無線局より複数の他の無線局に対して、前記グループ毎に同報データの伝送が行われ、伝送が完了したグループ毎に、順次、該グループに属する他の無線局と一の無線局との回線が切断される。また、請求項2によれば、複数の他の無線局がその受信性能、所在地等に基づいて2以上のグループに分割され、一の無線局より複数の他の無線局に対して、前記グループ毎に同報データの伝送が行われ、伝送が完了したグループ毎に、順次、該グループに属する他の無線局と一の無線局との回線が切断される。また、請求項3によれば、同報データの伝送に先立って、一の無線局から複数の他の無線局までの回線の品質がそれぞれ測定され、該測定結果並びにその受信性能、所在地等に基づいて複数の他の無線局が2以上のグループに分割され、一の無線局より複数の他の無線局に対して、前記グループ毎に同報データの伝送が行われ、伝送が完了したグループ毎に、順次、該グループに属する他の無線局と一の無線局との回線が切断される。

【0013】

【実施例】図1は本発明の無線通信における同報データ伝送方法の一実施例を示すもので、図中、1は通信衛星、2は通信衛星1の照射エリア、10は送信局、20-1、20-2、20-3は受信局、30は送信データ、40-1、40-2、40-3は受信データである。

【0014】送信局10は、回線品質測定部11と、グループ分割部12と、データ伝送部13-1及び13-2と、制御部14とを備えている。回線品質測定部11は同報データの伝送に先立って、各受信局20-1～20-3までの回線の品質をそれぞれ後述する如くして測定する。グループ分割部12は前記回線品質測定部11で求められた測定結果に基いて各受信局20-1～20-3を2以上のグループ、ここでは回線品質の良いグループG1と、回線品質の悪いグループG2とに分割する。データ伝送部13-1及び13-2はそれぞれグループG1及びG2に属する受信局に対してSR-ARQ方式によるデータ伝送を独立して実行する。制御部14は前記各部を制御して回線品質の測定、グループ分割、同報データ伝送を実行させるとともに、受信局に対する各種の情報の通知、回線の接続及び切断制御等を行う。

【0015】受信局20-1～20-3は、それぞれグループ情報保持部21と、データ抽出部22と、制御部23とを備えている(但し、図面の都合上、これらは受信局20-3においてのみ示す。)。グループ情報保持

部21は送信局10より通知されるグループ情報、ここではグループ番号G1又はG2を保持する。データ抽出部22は受信されるデータ中より該当するグループ対応のデータのみを抽出する。制御部23は前記各部を制御してグループ情報保持、データ抽出を実行させるとともに、送信局に対する各種の応答信号の送出等を行う。

【0016】図4は前記システムにおける送信データのフレーム構成並びに受信局からの応答信号の送信タイミング及びそのフレーム構成の一例を示すものである。図中、30aは送信データ30の1フレームを示し、ユニ
10 クワードa1、制御信号a2及びデータa3から構成されている。また、図中、50-1、50-2、50-3はそれぞれ受信局20-1、20-2、20-3の応答信号であり、これらの信号は送信データ30の制御信号a2中に設定されて伝送されるタイミング情報に基づいて互いに衝突しないように時分割的に送信される。該応答信号50-1～50-3の1フレームはユニク
20 ワードb1、制御信号b2及びデータb3から構成され、この応答信号50-1～50-3は受信局20-1～20-3毎の回線品質の測定やARQのための応答信号として使用される。

【0017】次に、前記システムの動作について説明する。

【0018】まず、送信局10の制御部14は送信データ30中の制御信号b2を用いて回線品質の測定を行う旨を全受信局に通知する。各受信局20-1～20-3は前記通知を受信すると、制御部23により応答信号のデータb3中に回線品質の測定のためのPNパターンを設定するとともに、制御信号b2中に該PNパターンを
30 伝送中である旨を示す情報を設定して、これを送信する。

【0019】送信局10は前記応答信号を受信すると、回線品質測定部11において該応答信号中のPNパターンと、内部で発生したPNパターンとを比較することにより各受信局20-1～20-3までの回線品質を測定する。なお、各受信局20-1～20-3の識別は応答信号の制御信号b2中にそれぞれの局番号を設定することにより実現可能である。

【0020】次に、送信局10はグループ分割部12により、前述した回線品質の測定結果に基づいて受信局20-1～20-3をグループG1及びG2に分割、例えば受信局20-1、20-2をグループG1に、また、受信局20-3をグループG2に分割する。さらに、送信局10の制御部14は前記グループ分けの結果を送信データ30を用いて、即ち制御信号a2に受信局の局番号を、また、データa3にグループ番号を設定して各受信局20-1～20-3へ通知する。なお、この通知は充分な信頼度を保証する必要があるため、複数のフレームに亘って連続送信する。各受信局20-1～20-3は前記通知を受信すると、対応するグループ番号をグルー
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ブ情報保持部21にそれぞれ書込む。

【0021】その後、送信局10の制御部14は送信データ30の制御信号a2を用いて同報データの伝送開始を全受信局に通知し、該通知を受信した各受信局20-1～20-3はデータ伝送待ち状態となる。

【0022】次に、送信局10の制御部14は伝送しようとするデータに対して、データフレーム毎にその制御信号にグループ番号を付加し、各グループG1及びG2に対応したデータとなして、データ伝送部13-1及び13-2に分配する。データ伝送部13-1及び13-2はそれぞれグループG1及びG2に対応するデータを1フレーム毎に交互に組合せて送信データ30となし、これを各受信局20-1～20-3に送信する。

【0023】前記送信データ30は各受信局20-1～20-3において、それぞれ受信データ40-1～40-3（内容は送信データ30と同一）として受信されることになるが、各受信局20-1～20-3のデータ抽出部22はそれぞれ受信データ40-1～40-3から該当するグループ対応のデータのみ、即ち受信局20-1、20-2ではグループG1対応のデータフレームのみを、また、受信局20-3ではグループG2対応のデータフレームのみを抽出し、受信する。また、この際、正しく受信できないデータフレームがあれば、各受信局20-1～20-3の制御部23は応答信号の制御信号b2中に局番号又はグループ番号及び再送要求である旨を示す情報を設定するとともに、データb3中にそのフレーム番号を設定して、これを送信する。

【0024】その後、いずれかのグループにおけるデータの伝送が完了したら、送信局10は送信データ30の制御信号a2を用いて該当グループに属する受信局に対して、同報通信の回線の切断を通知する。

【0025】なお、送信データ30及び受信データ40-1～40-3の各フレームに付された数字(1-1)、(2-1)、(1-2)、(2-2)中、前方の数字はグループ番号を、また、後方の数字はフレーム番号をそれぞれ示す。

【0026】図5は前記システムにおける同報データの伝送例を示すもので、図中、31は送信データ、41-1、41-2、41-3は受信データである。なお、受信データ41-1～41-3中、斜線の入ったフレームは誤って受信されたデータフレームを示す。ここでは受信データ41-3においてフレーム番号(1)～(3)のデータが誤って受信され続けている、即ちグループG2に属する受信局20-3にフレーム番号(1)～

(3)の全てのデータが誤って受信され続けているが、受信データ41-1及び41-2においてフレーム番号(1)～(3)のデータが正しく受信されている、即ちグループG1に属する受信局20-1及び20-2にフレーム番号(1)～(3)の全てのデータが正しく受信されているため、送信データ31中にグループG1に対応するフレーム番号(1)～(3)のデータフレームが

繰返し送出されることはない。この結果、受信局20-1及び20-2は受信局20-3に対する送信データ、即ちフレーム番号(1)～(3)のデータフレームの繰返しに拘りなく、新たなフレーム番号(4)、(5)、……のデータフレームを受信することが可能となる。

【0027】なお、前記実施例では回線品質の測定結果に基いて各受信局をグループ分けしたが、受信局のアンテナの種類(ヘリカルアンテナか電子追尾アンテナか等)、所在地(照射エリアの中央か端か、海上にいるか陸上にいるか等)、受信性能等から予めグループ分けし

【0028】図6は本発明における同報データの他の伝送例を示すもので、ここではグループG1に対してSR-ARQ方式により、また、グループG2に対してSR-ARQと誤り訂正とを組合せたFEC/ARQ方式により、同報データ伝送を行うようになした場合を示す。即ち、図中、32は送信データ、42-1、42-2、42-3は受信データであり、受信データ42-1～42-3中、間隔の狭い斜線の入ったフレームは誤って受

【0029】本実施例はグループG1に属する受信局20-1、20-2は回線品質が良く、SR-ARQ方式により伝送効率の高いデータ伝送が可能であるが、グループG2に属する受信局20-3は回線品質が悪く、SR-ARQ方式では充分な伝送効率を得られないので、FEC/ARQ方式によりデータ伝送を行うようになしたものであり、グループG2に属する受信局がグループG1に属する受信局に影響を与えずに済むだけでなく、グループG2に属する受信局に対しても効率の良いデータ伝送が可能となる。

【0030】図7は本発明における同報データのさらに他の伝送例を示すもので、ここではグループG1及びG2に対してSR-ARQ方式を適用するとともに、データフレームの伝送はグループG1から行い、該グループG1に対する伝送が完了してからグループG2に対するデータフレームの伝送を行うようになした場合を示す。即ち、図中、33は送信データ、43-1、43-2、43-3は受信データであり、受信データ43-1～43-3中、斜線の入ったフレームは誤って受信されたデータフレームを示す。

【0031】本実施例によれば、グループG1に対するデータの伝送中はグループG2に対するデータの伝送が行われず、また、グループG1に属する受信局は回線品質が良く、伝送効率の高いデータ伝送が可能であるから、該グループG1に属する受信局20-1、20-2に対するデータ伝送を、回線品質の悪いグループG2に属する受信局20-3の影響を受けることなく、極めて

短時間に完了させることができる。

【0032】なお、本発明において、ARQ方式を用いることなく、予め各グループ毎にその回線の品質に応じて決めた回数だけデータを送信するようになしても良い。また、これまでの説明では送信局と、受信局とを別のものとして説明したが、いずれの無線局が送信局となるか又は受信局となるかは任意である。

【0033】

【発明の効果】以上説明したように本発明の請求項1によれば、一の無線局から複数の他の無線局までの回線の品質をそれぞれ測定することにより、受信側の複数の他の無線局を回線品質毎に2以上のグループに分けることができ、送信側の一の無線局より受信側の複数の他の無線局に対して該分割したグループ毎に同報データの伝送を行うことにより、回線品質の良いグループに属する無線局が回線品質の悪いグループに属する無線局の影響を受けることがなく、効率の良いデータ伝送を行うことが可能となり、また、伝送が完了したグループ毎に、順次、該グループに属する受信側の無線局と送信側の無線局との回線を切断することにより、回線品質の良いグループに属する無線局を回線品質の悪いグループに属する無線局よりも先に同報データの回線から開放させることができ、無意味に束縛することなく、他の通信を行うことができる。

【0034】また、本発明の請求項2によれば、同報データの伝送に先立って一の無線局から複数の他の無線局までの回線の品質をそれぞれ測定することなく、その受信性能、所在地等に基づいて受信側の複数の他の無線局を回線品質毎に2以上のグループに分けることができ、その分、工程が簡略化され、各無線局にかかる負担が軽くなる。

【0035】また、本発明の請求項3によれば、一の無線局から複数の他の無線局までの回線の品質をそれぞれ測定した結果並びにその受信性能、所在地等に基づいて、受信側の複数の他の無線局を回線品質毎に2以上のグループに分けることができ、より正確なグループ分けを行うことができる。

【図面の簡単な説明】

【図1】本発明の無線通信における同報データ伝送方法の一実施例を示すシステム構成図

【図2】従来の無線通信における同報データ伝送方法の一例を示すシステム構成図

【図3】図2のシステムにSR-ARQ方式を適用した場合の同報データの伝送例を示す説明図

【図4】図1のシステムにおける送信データのフレーム構成並びに受信局からの応答信号の送信タイミング及びそのフレーム構成の一例を示す説明図

【図5】図1のシステムにおける同報データの伝送例を示す説明図

【図6】本発明における同報データの他の伝送例を示す

説明図

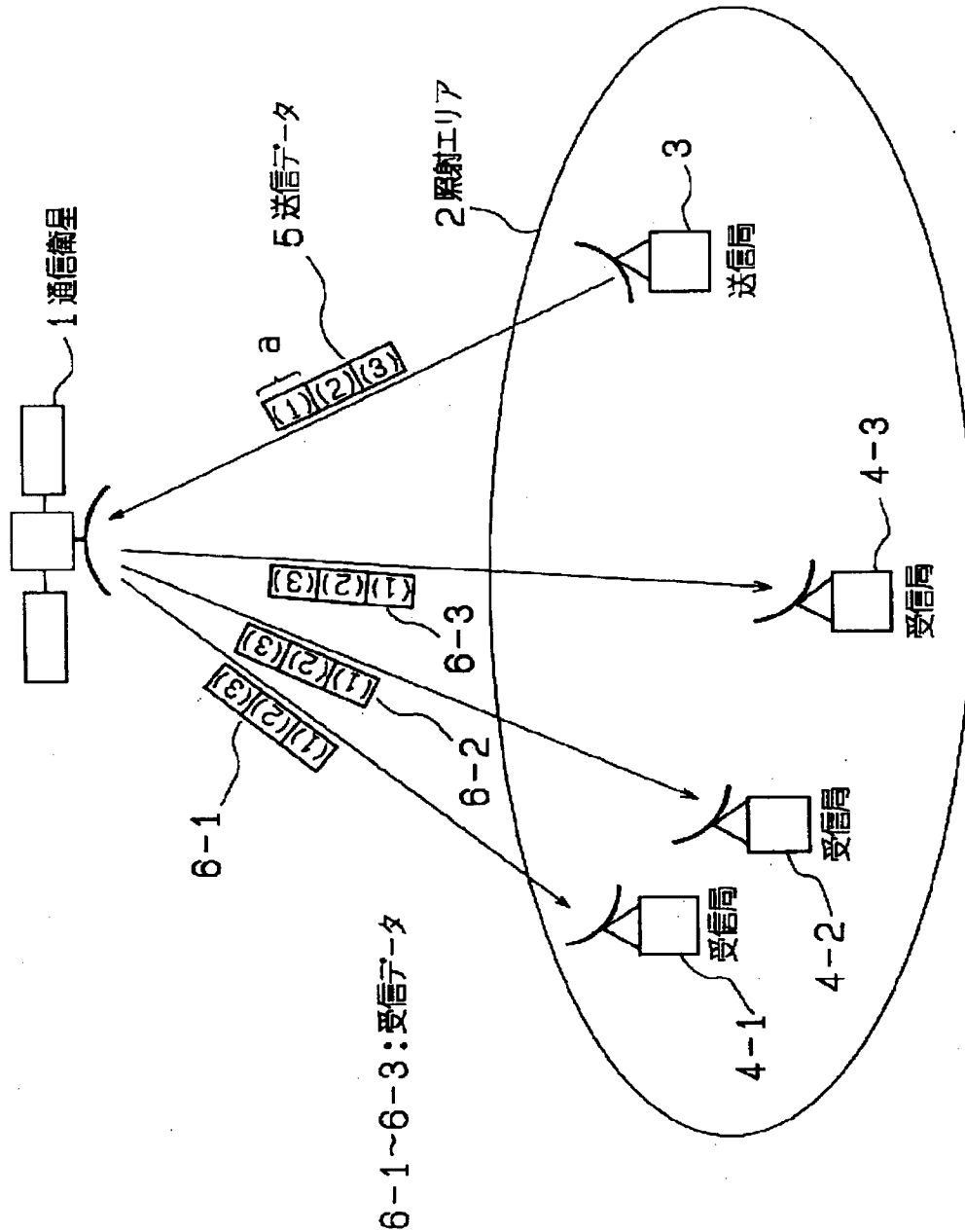
【図7】本発明における同報データのさらに他の伝送例を示す説明図

【符号の説明】

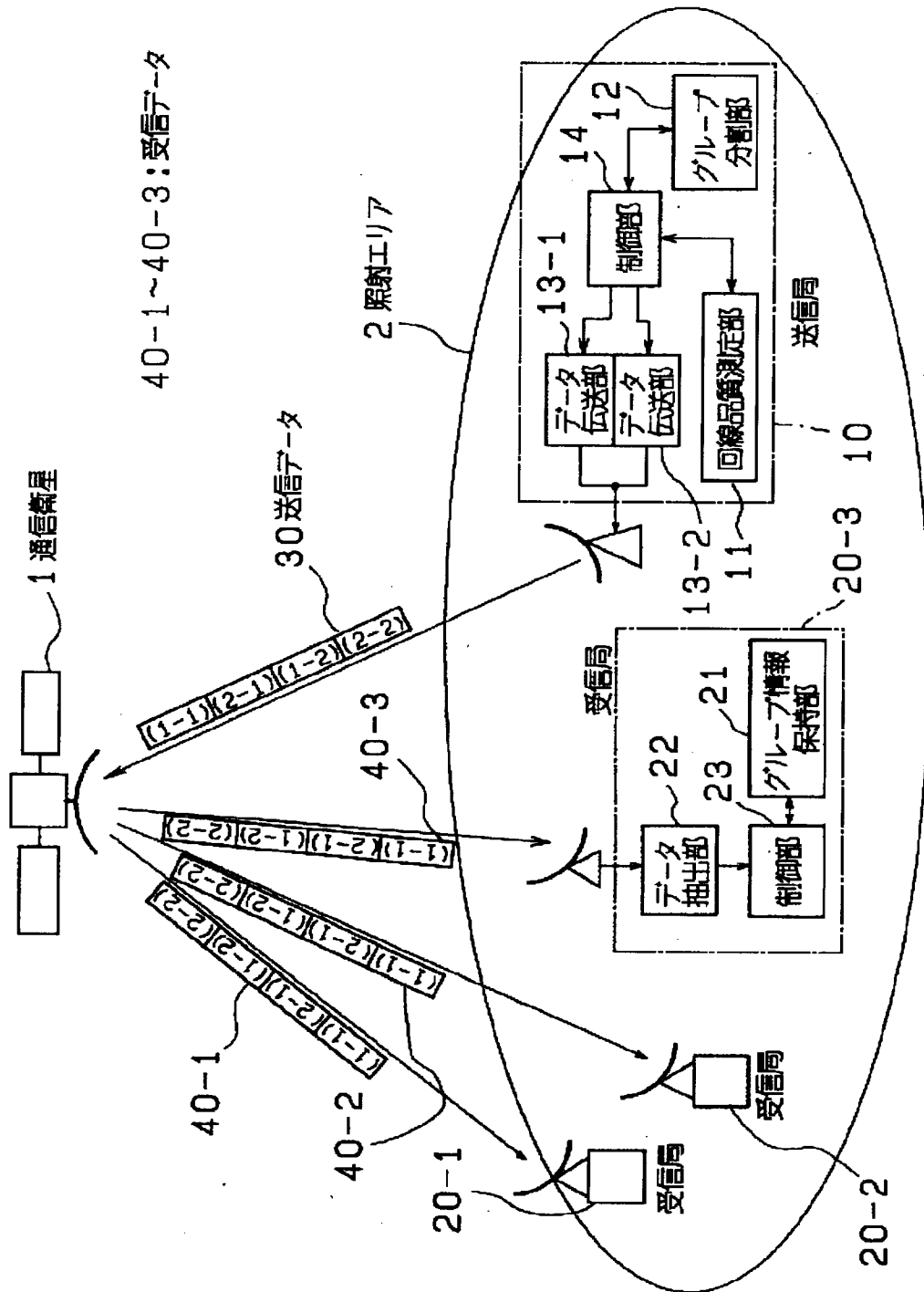
1…通信衛星、2…照射エリア、10…送信局、11…回線品質測定部、12…グループ分割部、13-1、13-2…データ伝送部、14、23…制御部、20-1*

* ~ 20-3…受信局、21…グループ情報保持部、22…データ抽出部、30、31、32、33…送信データ、40-1~40-3、41-1~41-3、42-1~42-3、43-1~43-3…受信データ、50-1~50-3…応答信号、a1、b1…ユニークワード、a2、b2…制御信号、a3、b3…データ。

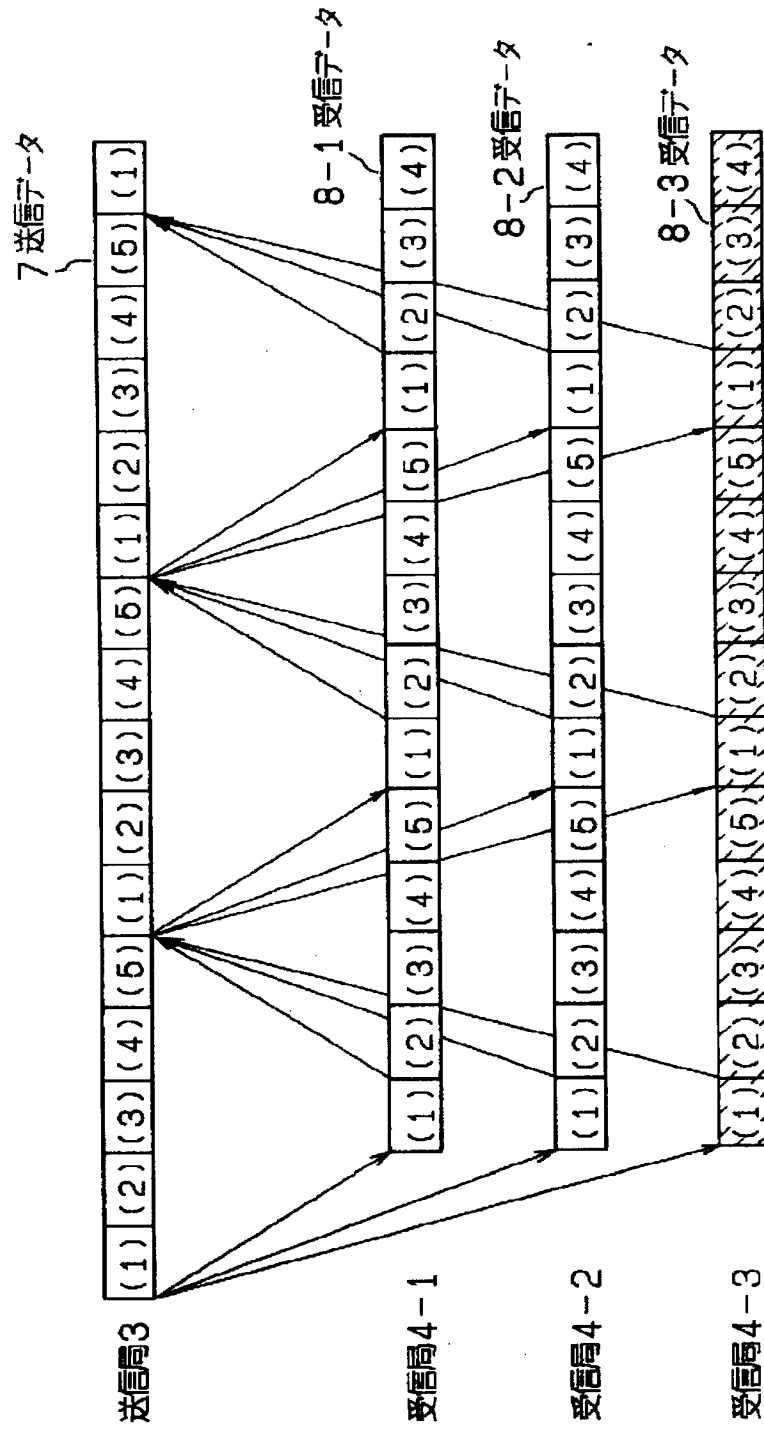
【図2】



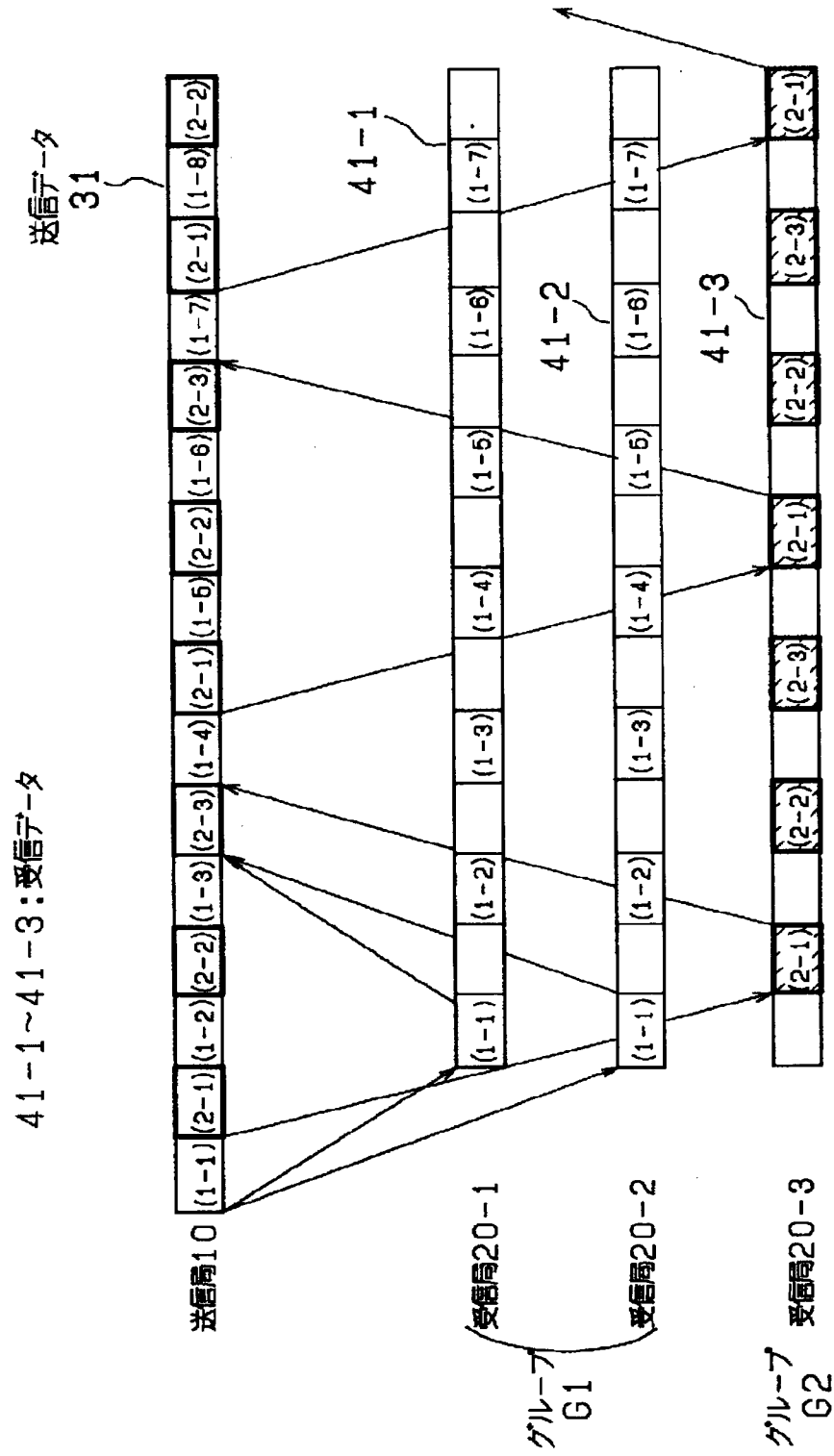
【図1】



【図3】

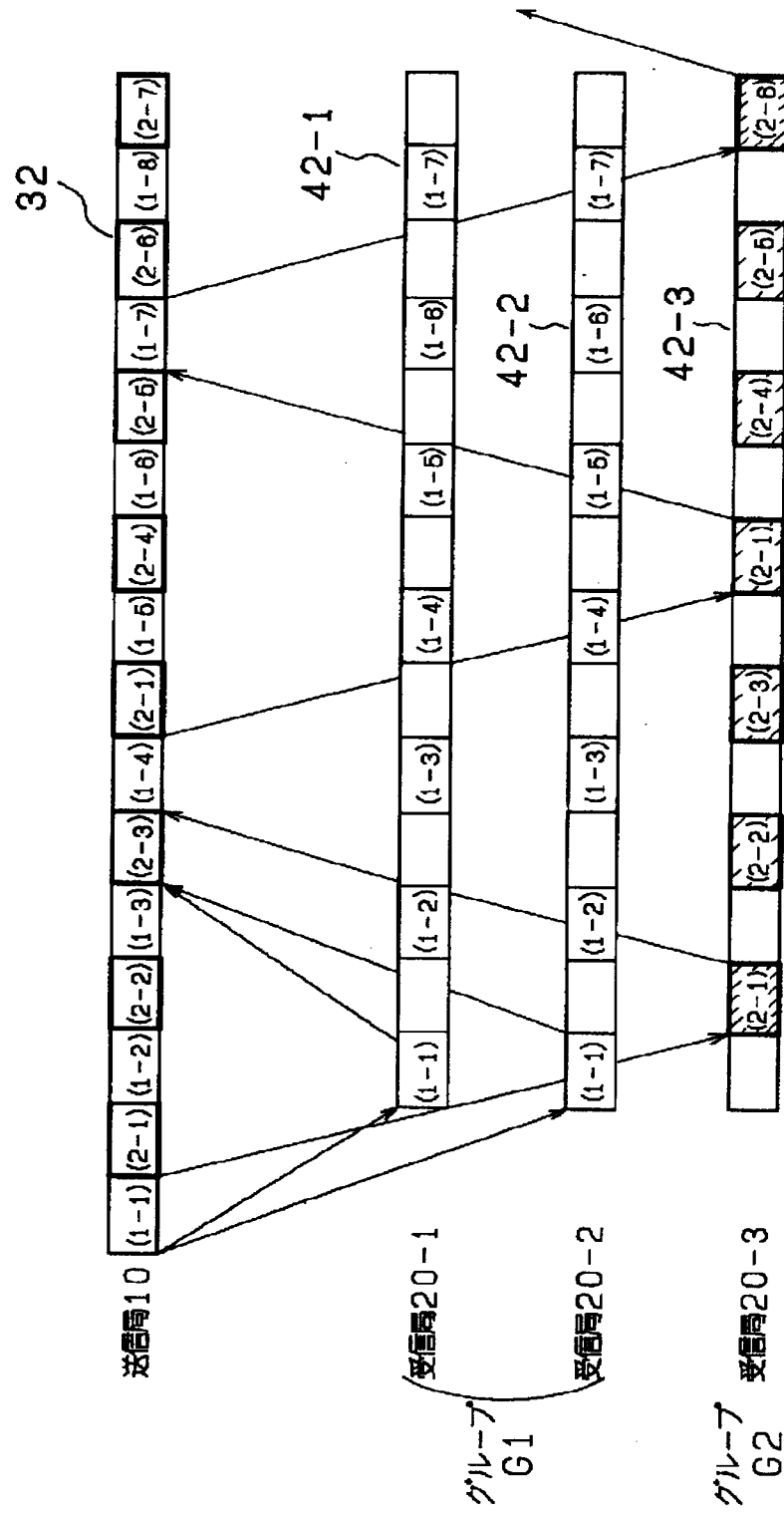


【図5】



【図6】

42-1~42-3:受信データ



【図7】

